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A new species of cardinalfish (Perciformes: Apogonidae) from the Bay of Bengal, Indian Ocean

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Abstract.—A new species, *Apogon oxina,* is described from the Bay of Bengal, Indian Ocean. The preserved color pattern suggests a close relationship with *Apogon ventrifasciatus* from the West Pacific. The new species lacks the white spot at the posterior base of the second dorsal fin present in several other species and has darker and sharper stripes on the head and upper body and well-developed bars on the sides reaching to or above the lateral line.

New species of the large cardinalfish genus *Apogon* continue to be recognized and described at a surprisingly high rate. Most of these species are from the Indo-Pacific region, with the majority in the large subgenus *Ostorhinchus.* There are about 111 valid species in this subgenus, of which about 21 undescribed species are known to me. Relationships within this large group are not well understood. Gon (1996) proposed phyletic relationships within his concept of the *Apogon* subgenus *Jaydia.* His detailed analysis illustrates the complexities of developing a robust hypothesis for relationships within species groupings of *Apogon* prior to testing with an inclusive analysis all of proposed subgenera, other species groupings of *Apogon* and other genera. Fraser (1972) suggested that a more complete understanding of supra-specific relationships, within and without *Apogon,* was dependant on well developed systematics of the species. Such a critical mass of information and material is emerging.

Color patterns and variations of those patterns appear to be the best distinguishing features of closely related species of *Apogon.* New species usually are first recognized by unique color patterns. Consistent color pattern differences between closely related species may be accompanied by a few morphometric differences, such as body depth, caudal peduncle length, spine lengths, soft fin-ray lengths, jaw length and eye diameter, or modally different counts for gill rakers and pectoral fin-rays. Other differences have been noted by many authors, such as meristic changes in the spine count of the first dorsal fin and soft rays of the second dorsal and anal fins; loss of the supramaxilla, supraneurals at the anterior end of the dorsal fin, one pair of epipleural ribs and uroneurals in the caudal skeleton; fusion of some hypurals in the caudal skeleton; character of spination of the postemporal, preopercle, infraorbitals; coloration of the stomach, intestine and peritoneum; presence or absence of known or potential bioluminescent ability; shape of the caudal fin; elongation of individual vertical fin rays; position of the anal opening between the pelvic and anal fins; general scale size, elaboration of pore architecture on scales as a simple pore, complex pores, or pit in scale; and the degree of ossification of the preopercle. *Apogon* and the family, in general, are replete with internal and external character variation not usually seen within a single percoid family. Nevertheless, some allopatric species pairs, for example, *Apogon abrogramma-Apogon exostigma* and *Apogon taeniopterus-Apogon menesemus* proposed by Fraser & Lachner (1985) differ only in color pattern. No morphometric, in-

ternal, or meristic differences within those species pairs are known.

The new species belongs in the subgenus *Ostorhinchus* Lacepède, 1802 as defined by Fraser (1972) using the name *Nectamia* Jordan, 1917. Gon (1987) designated a neotype for *Apogon fleurieu* (Lacepède 1802) and effectively relegated *Nectamia* as a synonym.

Methods

Methods of taking and recording meristic data and measurements are given in Fraser & Lachner (1985). All measurements are in millimeters to the nearest 0.1. The following acronyms are used to designate institutions and collections cited and follow general usage given in Eschmeyer (1998); BPBM Bernice P. Bishop Museum, Honolulu; CAS California Academy of Sciences, San Francisco; MNHN Muséum National d'Histoire Naturelle, Paris; USNM collections of the former United States National Museum, deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Field station numbers are listed for additional collection information, for example PCH-69-279.

Apogon oxina, new species
Fig. 1

Material examined.—Holotype: *Apogon oxina* CAS 33959, 55.9 mm SL; India, Madras; in 15–22 m; April–June 1975; K. V. Rama Rao. Paratypes: India: CAS 98101; 7(43–71); data same as holotype. Sri Lanka: USNM 213364 55(44–58); Trincomalee; 10 m; PCH 69-277; 29 Sep 1969; Phillip C. Heemstra. USNM 213345 (43–44); PCH 69-279; 30 Sep 1969; Phillip C. Heemstra. Other material: Sri Lanka: USNM 213346 4(19–28); Trincomalee; CCK 69-135; 10–20 m; Christopher C. Koenig; 4 Apr 1970.

Comparative material.—Paratypes *Apogon ventrifasciatus* BPBM 34136 7(35–49); Indonesia, Flores I., Maumere Bay; 8 m; J. E. Randall; 19 Sep 1988. BPBM 34085 5(27–41); Indonesia, Flores I., Maumere Bay; 3–4 m.; J. E. Randall; 17 Sep 1988. Other material. USNM 328265 (45); Papua New Guinea, D'Entrecasteau Is., Normandby I.; 16 Dec 1993. BPBM 30132 (40–53); Indonesia, Lombok I., Sorongjunkung; J. E. Randall; 21 Feb 1974. Holotype *Apogon moluccensis* MNHN 8707; 60.3 mm SL, 76 mm TL; Amboina; Quoy and Gaimard.

Diagnosis.—An *Apogon* of the subgenus *Ostorhinchus* with 14 pectoral fin-rays, usually 23–24 total gill rakers on the first arch, no white spot behind the second dorsal fin, dark vertical bars present on body reaching to or past the lateral line, dark stripes present on head and upper body, and caudal peduncle length 20–25% SL.

Description.—For general body shape see Fig. 1. Range of proportions (as percentages of standard length) with the holotype in parentheses: greatest body depth 36–39 (39); head length 38–41 (41); eye diameter 12–13 (12.2); snout length 8–9 (9.5); bony interorbital width 7–8 (7.5); upper jaw length 18–20 (19); caudal peduncle depth 15–17 (16); caudal peduncle length 20–25 (23); first dorsal-fin spine length 2.8–3.8 (2.8); second dorsal-fin spine length 7.9–9.7 (8.0); third dorsal-fin spine length 17–20 (20); fourth dorsal-fin spine length 16–21 (21); second dorsal spine 12–16 (15); first anal-fin spine length 1.9–3.3 (2.3); second anal-fin spine length 11–12 (11); pectoral fin length 23–27 (23); pelvic fin length 23–26 (26).

Dorsal fin VII–1,9; anal fin II,8, last anal ray much longer than preceding fin-ray; pectoral fin-rays 14–14; pelvic fin 1,5; principal caudal fin-rays 9 + 8; pored lateral line scales 24; transverse scale rows above lateral line 2; transverse scale rows below lateral line 6; median predorsal scales 3–4 (4); circumpeduncular scale rows 12 (5+2+5); total gill rakers 23–24 (24), usually 20–22 (21) well developed 1–2+4–5 upper, 15–17+0–2 lower (2+5–16+1).

Villiform teeth in a band on premaxilla; two to three rows on dentary; one row on palatine and vomer; none on ectopterygoid, endopterygoid or basihyal.

Fig. 1. The holotype of *Apogon oxina*, 55.9 mm SL, from Madras, India, CAS 33959.

Vertebrae 10 + 14. Five free hypurals, one pair of slender uroneurals, three epurals, a free parhypural. Three supraneurals, two supranumerary spines on first dorsal pterygiophore. Basisphenoid present. Supramaxilla absent. Posttemporal serrate on posterior margin. Preopercle serrate on vertical and horizontal margins. Infraorbital shelf present on third bone. Scales ctenoid. Simple pored lateral-line scales from posttemporal to caudal fin, pored scales usually 24.

Life colors.—Unknown.

Preserved color pattern.—In 70% ethyl alcohol: Adult pattern: five dark stripes on each side of head with one (unpaired) mid-nape from snout to origin of first dorsal fin, two stripes over eye extending onto body above lateral line, the dorsal stripe along base of first dorsal fin reaching to or just beyond origin of second dorsal fin, the ventral one reaching well past origin of second dorsal fin; two stripes behind eye, neither extending onto body, the upper one reaching below the posttemporal and the lower one from snout, continuing behind eye along midline of head to edge of opercle above pectoral fin; one stripe extending from lower lip below eye onto opercle ending near pectoral fin base; four or five narrow dark bars from abdomen to first stripe above lateral line on body, first bar just behind and below pectoral fin reaching to lateral line, second bar beginning on abdomen near mid-pelvic fin length reaching past lateral line merging with first stripe above lateral line, third bar beginning on abdomen near posterior tip of pelvic fin reaching above lateral line merging with first stripe above lateral line, fourth bar beginning above anterior end of anal fin reaching above lateral line, and a faint indication of a fifth bar beginning about mid-anal fin base reaching above lateral line; first dorsal fin dusky; melanophore patterns indicate stripe may be present in second dorsal fin and in anal fin; faint dark mark at posterior base of second dorsal; edges of caudal fin pale, melanophore patterns indicate remains of mid-stripe on caudal fin; outer edge of pelvic fin dusky; stomach and intestine black, peritoneum pale. Juvenile pattern: mid-body lateral stripe extending from snout, continuing behind eye along midline of head and body onto caudal fin; 3–5 vertical bars reaching nearly to stripe just above lateral line; no melanophore patterns in the second dorsal or anal fin; other preserved patterns similar to adults.

Distribution.—Known from Madras, India and Sri Lanka.

Etymology.—The Greek word *oxina*

meaning rake or harrow, a feminine noun in apposition, referring to the vertical bars on the side reaching the stripe.

Remarks.—This new species of *Apogon* has a combination of characters suggesting a close relationships with *Apogon ventrifasciatus* Allen, Kuiter & Randall, 1994. *Apogon oxina* differs in lacking the white spot behind the second dorsal fin, having vertical bars reaching to or past the lateral line, a shorter caudal peduncle length (20–25% SL versus 25–31% SL), stronger and darker stripes and bars at all sizes, and an apparently larger size (71 mm SL versus 53 mm SL). Total gill-raker counts for the first arch overlap at 23–24 for *Apogon oxina* and 22–25 for *Apogon ventrifasciatus.* Both species have 20–22 well developed gill-rakers and have 15–17 well developed lower arch gill rakers.

Allen et al. (1994) compared their new species, *Apogon ventrifasciatus,* with *Apogon moluccensis* Valenciennes, 1832 mentioning some similarities in color pattern and a difference in the well developed lower arch gill raker count of 15–17 for *Apogon ventrifasciatus* and 20–21 for *Apogon moluccensis.* However, the type of *Apogon moluccensis* has 16 well developed lower arch gill rakers with no remaining color pattern other than a white spot at the posterior base of the second dorsal fin based on my examination. Valenciennes (1832) describes the type of *Apogon moluccensis* as having stripes on the nape, blackish lips, first dorsal fin with blackish tip and a reddish body lacking any marks or spots on or near the caudal fin. Two species with basal second dorsal-fin white spots and differing gill-raker counts exist and more species may be present based on color patterns. There are two Bleeker names which need to be considered in this group besides *Apogon ventrifasciatus: Apogon chrysosoma* Bleeker, 1852 and *Apogon monochrous* Bleeker, 1856. Gon (1987) identified *Apogon moluccensis* from the Maldives at Rasdu Atoll. He described the 38 mmSL specimen as having 6–7 vertical rows of spots on the body from the lateral line to the abdomen, stripes in the soft dorsal and anal fin, a white spot at the posterior base of the second dorsal fin, 21 well developed gillrakers on the first arch and 24(6+18) total gill rakers. The redescription of types and valid species of this group are under study by J. E. Randall, G. R. Allen and me. None of these white-spot nominal or possibly undescribed species have the combination of characters of *Apogon oxina.*

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